PRO-LOG® CORPORATION

STD 7000

7706
Battery Backed
Byte-Wide RAM Card

USER'S MANUAL

A Pro-Log OPENWARE™ Product

8/86

FOREWORD

This manual explains how to use Pro-Log's 7706 Battery Backed Byte-Wide RAM Card. It is structured to reflect the answers to basic questions that you, the user, might ask yourself about the 7706. We welcome your suggestions on how we can improve our instructions.

The 7706 is part of Pro-Log's Series 7000 STD BUS hardware. Our products are modular, and they are designed and built with second-sourced parts that are industry standards. They provide the industrial manager with the means of using his own people to control the design, production, and maintenance of the company's products that use STD BUS hardware.

Pro-Log supports its products with thorough and complete documentation. Also, to provide maximum assistance to the user, we teach courses on how to design with, and to use, microprocessors and the STD BUS products.

You may find the following Pro-Log documents useful in your work: the *Microprocessor User's Guide* and the *Series 7000 STD BUS Technical Manual and Product Catalog.* If you would like a copy of these publications, please submit your request on your company letterhead.

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Section 1
PURPOSE AND MAIN FEATURES

The 7706 Battery Backed Byte-Wide RAM Card provides 2, 4, 8, or 16K of nonvolatile RAM. While guaranteed data retention time of the RAM is two years, it is typically five years. For truly nonvolatile operation, a voltage monitoring circuit senses when power is below normal and protects the RAM from spurious writes as power goes down or comes up.

The 7706 also serves as a versatile general purpose memory card. It can be mapped to any 16K quadrant and its size can be tailored to 2K increments. It responds to the STD BUS memory expansion line (MEMEX) for two 64K memory banks and to an external Segment Select line for multiple 64K memory banks. It has four write inhibit switches which, when enabled, allow the memory to be used as ROM.

Simplicity of design and popular, high-speed, byte-wide RAMs are used for optimum cost effectiveness, reliablity, and high-speed operation.

FEATURES

- Operates with high-speed processors such as the 4 MHz Z80A
- Uses one ½-inch card slot
- 4, 8, and 16K byte versions
- 2 years' guaranteed data retention, 5 years typical
- Can be mapped to any 16K quadrant
- No wasted memory space—unused memory parts can be disabled.
- Write inhibit switches for data protection
- Processor independent—use with 8085, Z80A, 8088, 6800/09, and others
- Single +5V supply
- Two-year warranty

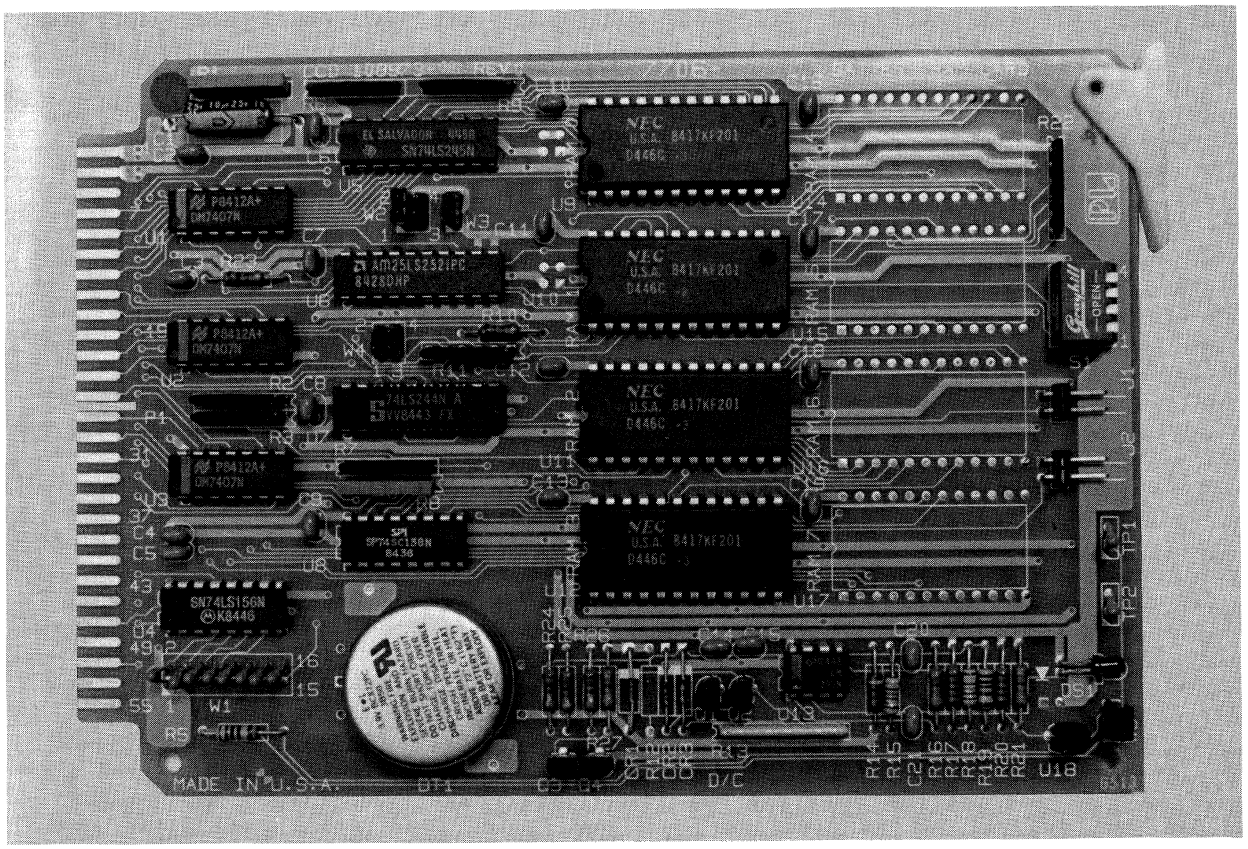


Figure 1-1. 7706 Battery Backed Byte-Wide RAM Card

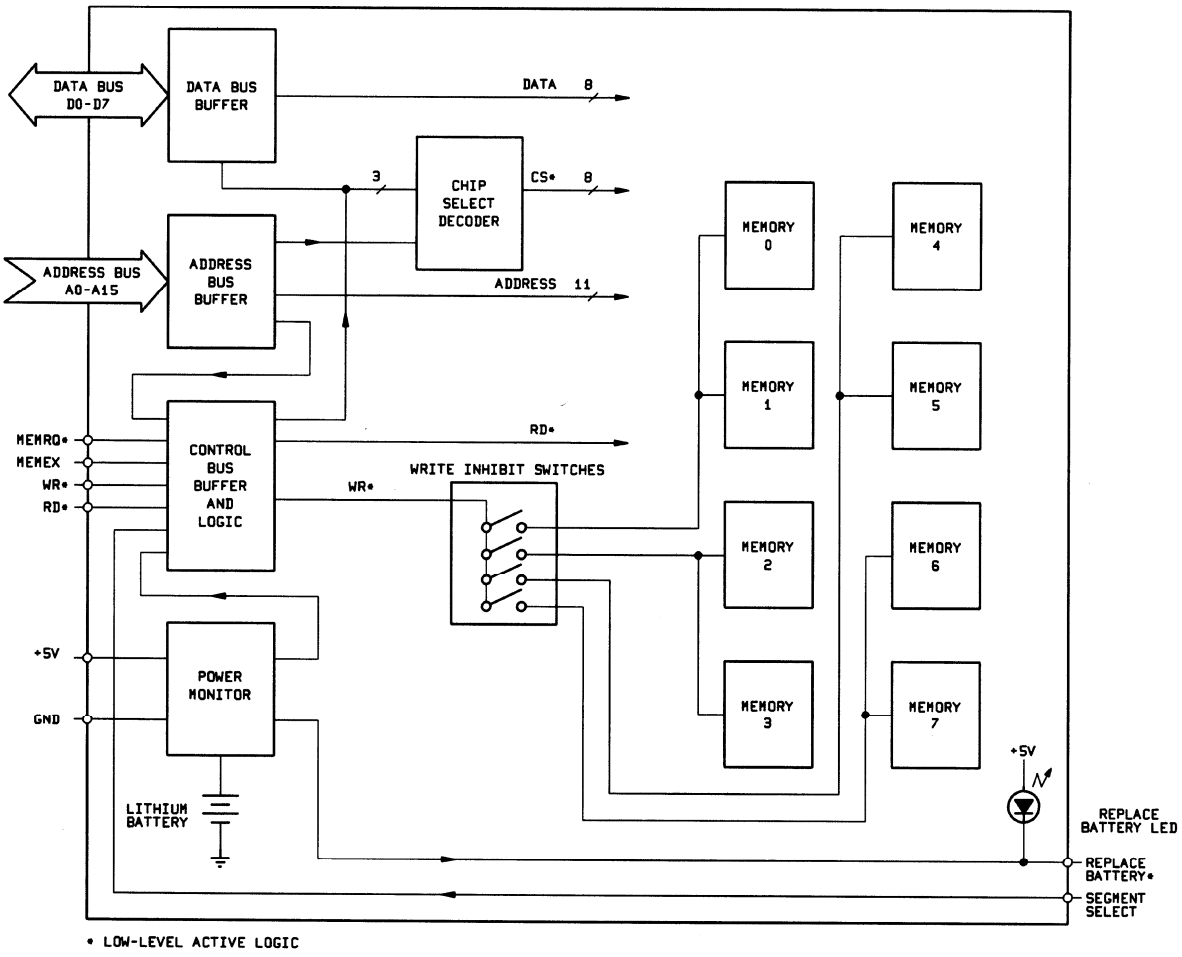


Figure 1-2. Block Diagram

Section 2
INSTALLATION AND SPECIFICATIONS

INTRODUCTION

This section reviews the optional functions of the 7706 and the installation of the card. Specifications are included at the end of this section.

INSTALLATION

The 7706 Battery-Backed Byte-Wide RAM Card functions as part of an STD BUS card rack system. It plugs directly into the STD BUS backplane. The 7706 can be inserted into any slot in the card rack with the card ejector tab at the top of the card, as shown in figure 2-1. If access to the card is needed, an extender card, such as Pro-Log's 7901 card, can be plugged into the card rack and the 7706 plugged into the extender card. Procedures for installing and removing the card with data retention are given in **Powering Up and Down with Data Retention** (page 3-1).

CAUTION

To prevent possible damage to your STD BUS system make sure power is **off** before inserting a card into the card rack or removing a card from the card rack.

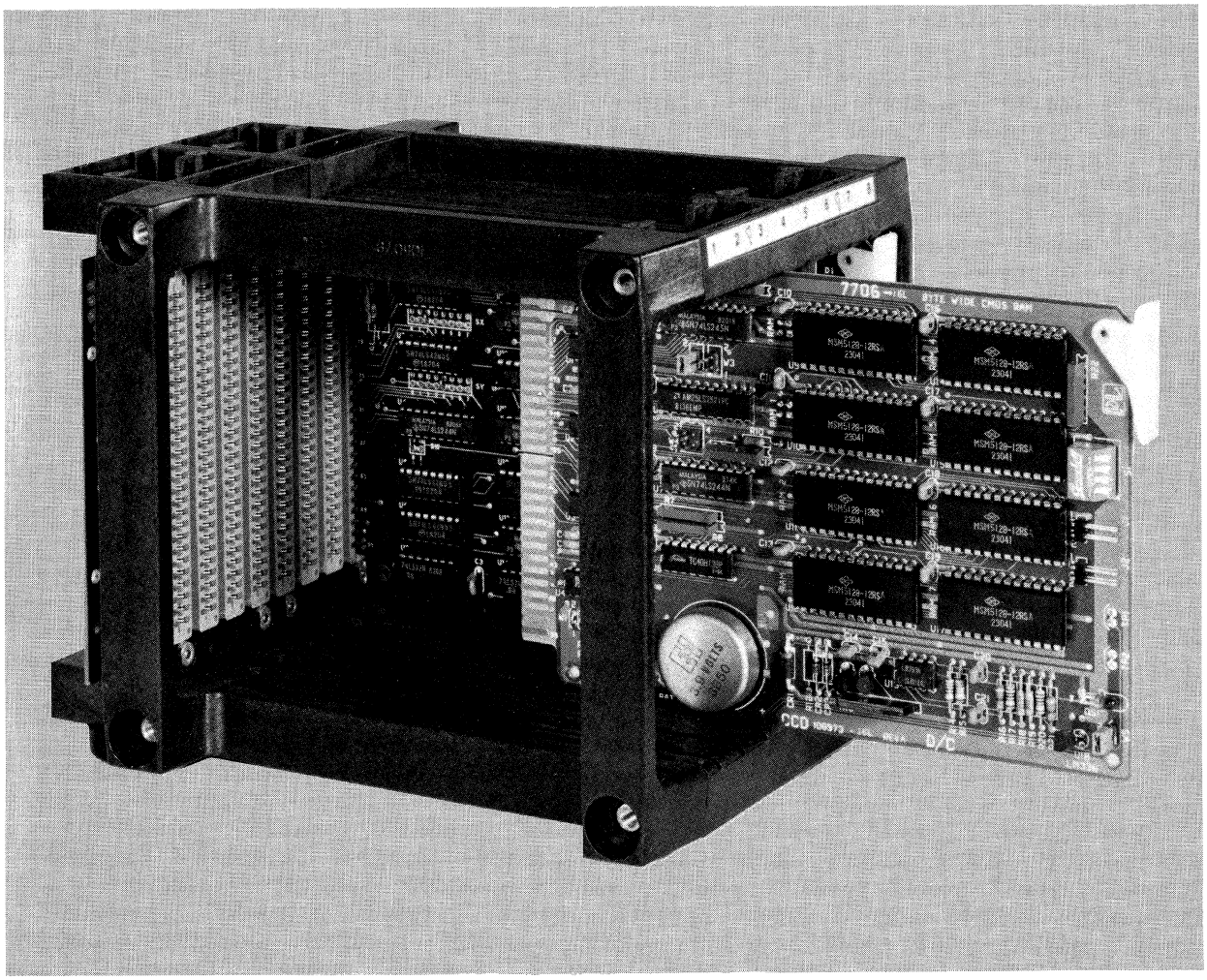


Figure 2-1. Installation

SEGMENT SELECT AND REPLACE BATTERY* CONNECTIONS

Two signals are accessible at the front edge of the card: Segment Select, for multiple memory banks, and Replace Battery*, to indicate when the battery is low. The location of these connectors is shown in figure 2-2. They are two-pin connectors with 0.025" pins on 0.1" centers. Each connector has a signal and a ground line. A twisted pair cable such as Pro-Log's RC704 should be used for connection to other cards. Compatible mating connectors include:

MANUFACTURER	HOUSING	SOCKET
AMP	530554-1	530553-5
BERG	65039-035	75691-015

The Segment Select signal can be driven by a TTL output line like that on Pro-Log's 7605 card or any spare TTL output lines available in your system (see figure 2-3). The Replace Battery* signal can be connected to an input line like that on the 7605 or to a priority interrupt controller, such as the Pro-Log 7320 card. Pro-Log's 7801 processor card has interrupt inputs and the 7804 processor card has a TTL input to which the Replace Battery* signal can be connected (refer to figure 2-4).

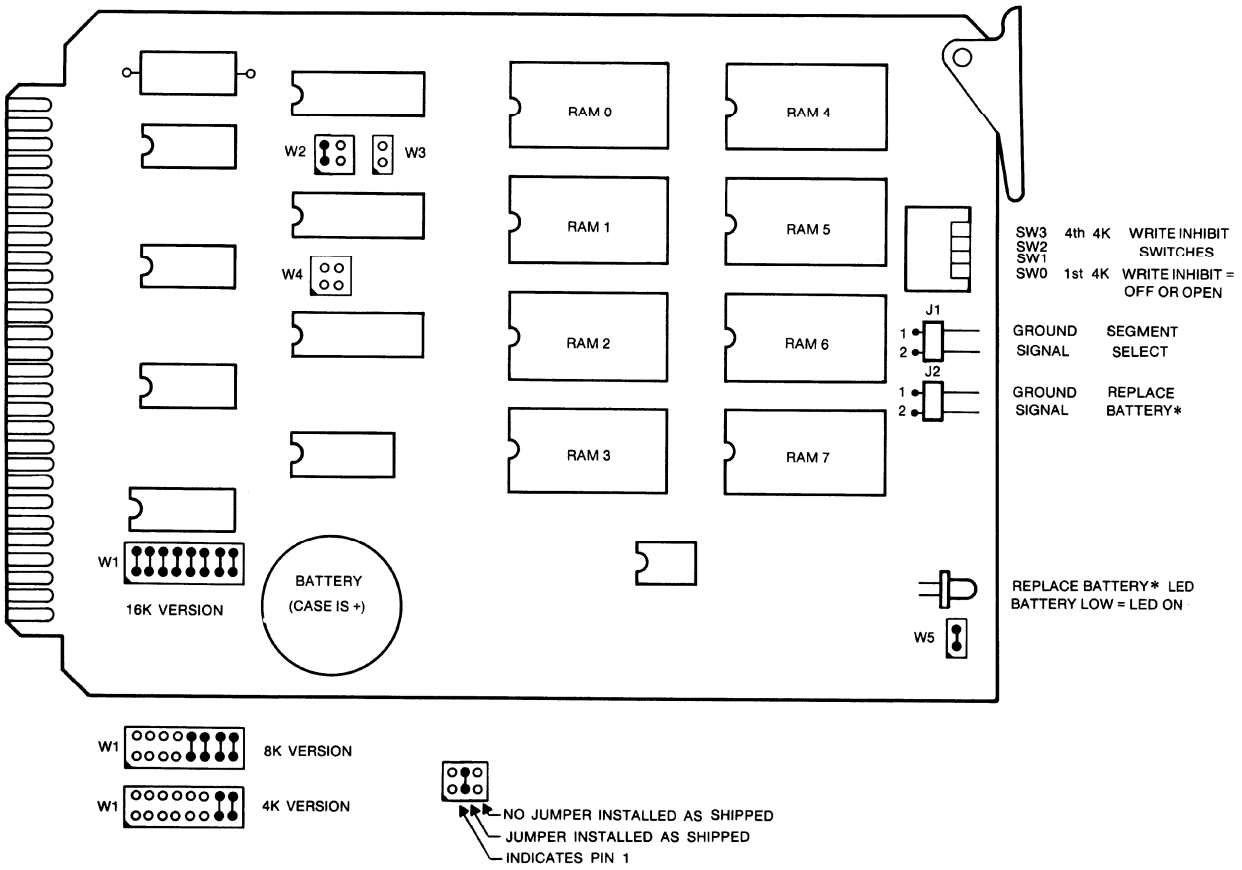


Figure 2-2. Location of Main Features

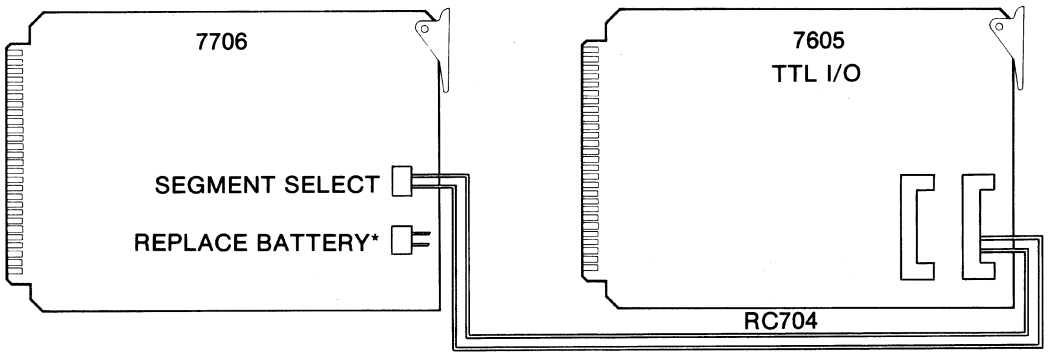


Figure 2-3. 7706 Segment Select Connection

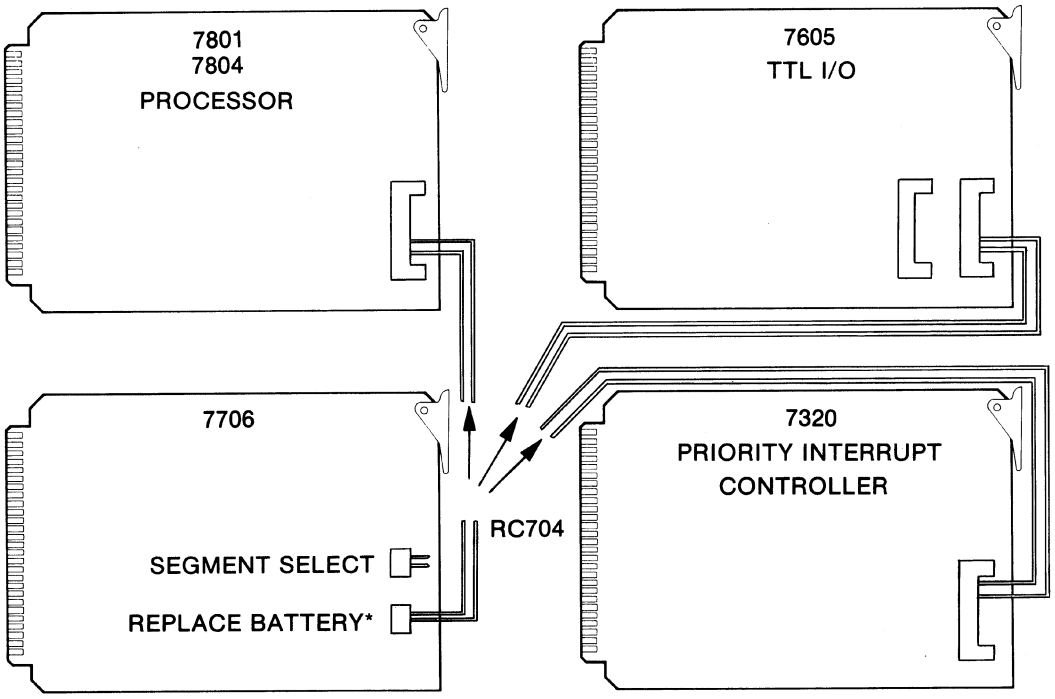


Figure 2-4. Replace Battery* Connection

JUMPER OPTIONS

The 7706 has several optional functions selectable by wire jumpers or wirewrap posts. The wirewrap posts can be connected by wirewrap or shorting connectors. Figure 2-5 shows the locations and functions of these jumpers and posts.

Jumpers W2, W3, W4, and W5 are wirewrap posts. Jumpers W2 and W5 come with shorting connectors of the type listed under the "Connector" heading of figure 2-6. This type of connector is short enough to allow the card to occupy one ½-inch card slot.

The jumpers in jumper block W1 are soldered-in wire jumpers. The number of jumpers installed in the jumper block depends upon the amount of memory supplied on the particular version of the 7706. These jumpers can be disconnected simply by cutting them. Be sure to cut them in two places to prevent reshorting. To replace a jumper, cut and remove one half at a time. Remove any excess solder and install new jumpers as needed. Be sure the nonconductive protecting backing on the card is replaced. Spare pads can be ordered from Pro-Log under part number 107100.

If there is a need to change these jumpers frequently (e.g., in prototyping), you may replace these wire jumpers with wirewrap posts like those used for the other jumpers. Figure 2-6 provides a list of part numbers for both the wirewrap posts and the shorting connectors.

JUMPER	DESCRIPTION	COMMENTS
W1	Chip Disables	Remove jumper to disable device Pins 15-16=RAM 0; Pins 1-2=RAM 7
W2	Memex Polarity	Jumper installed = MEMEX low-level active
W3	Segment Select Polarity	Jumper Installed = Segment Select Low-Level Active
W4	Memory Mapping	Selects one of four 16K Quadrants, see Pg. 2-7.
W5	Battery Enable	Jumper installed engages battery.

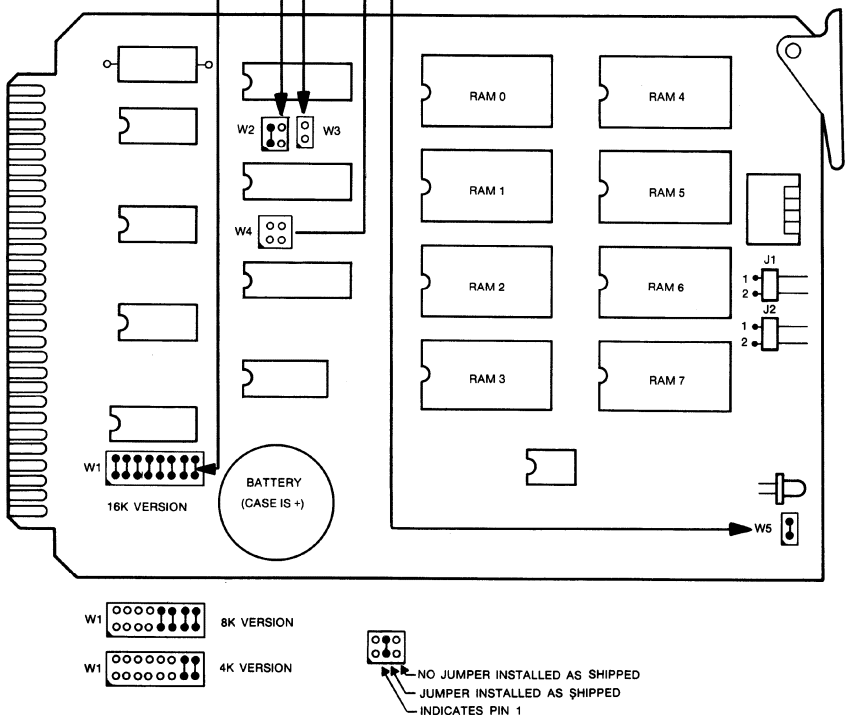


Figure 2-5. Jumper Locations and Functions

PART	MANUFACTURER PART NUMBER	
	ELCO CORP.	BERG ELECTRONICS
2-PIN HEADER	00 8261 02 32 00 852	65611-102
4-PIN HEADER	00 8261 04 32 00 852	65611-104
6-PIN HEADER	00 8261 06 32 00 852	65611-106
8-PIN HEADER	00 8261 08 32 00 852	65611-108
CONNECTOR	00 8261 02 42 00 870	

Figure 2-6. Replacements for Wire Jumpers

BATTERY BACK-UP

The battery back-up circuit on the 7706 retains data for at least two years, typically five years. This is true for both fully and partially populated versions. No significant difference in battery life occurs when using a partially populated card or keeping power applied to the card continuously.

Jumper W5 completes the battery back-up circuit. The card is shipped with the jumper installed. It should remain installed except to replace the battery or for repair. Frequent removal and installation of the jumper can shorten battery life due to the current surge that occurs when the battery is engaged.

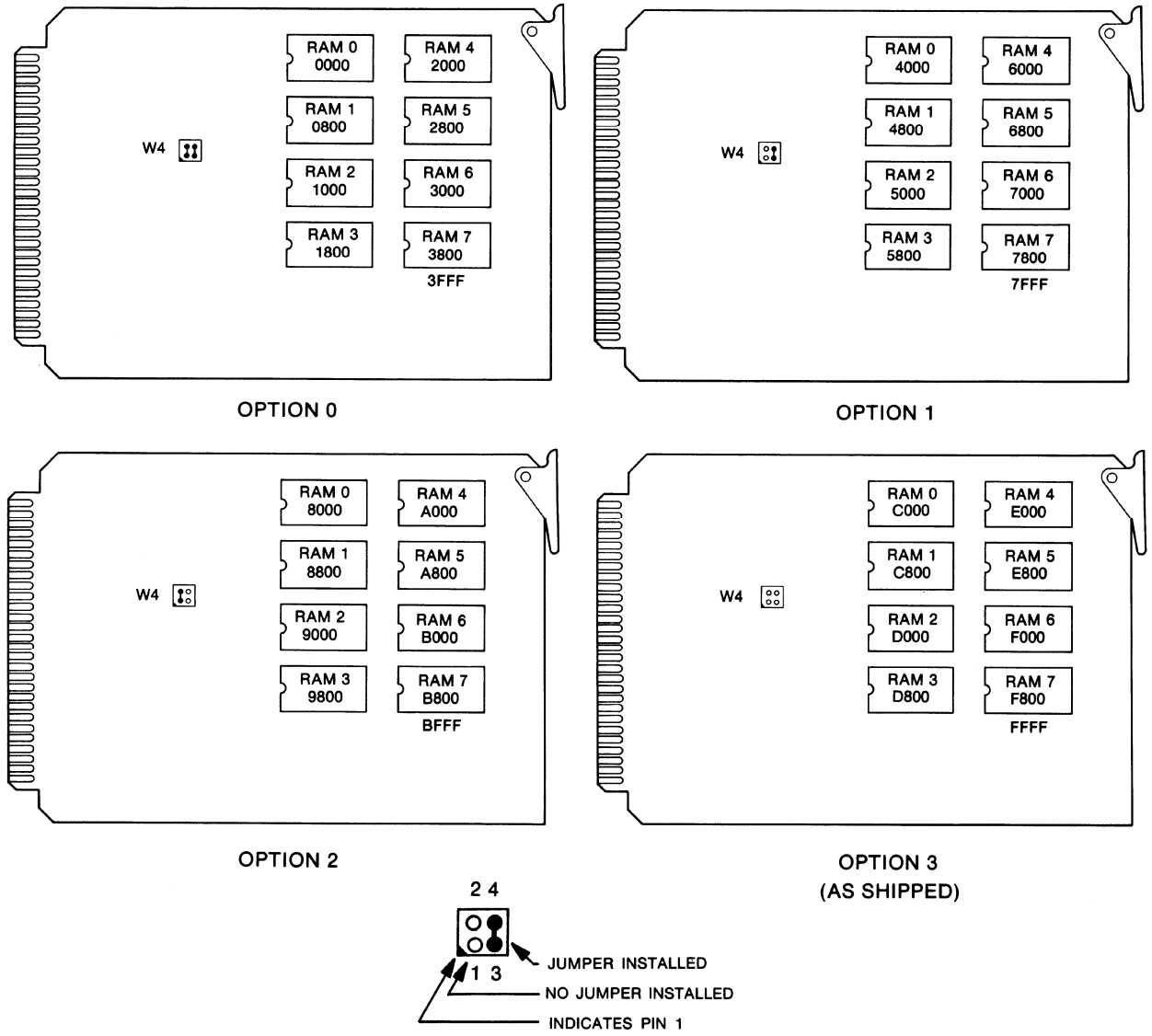


Figure 2-7. Memory Mapping Options

MEMORY MAPPING

Memory Addressing

The 7706 has four memory mapping options. Figure 2-7 shows the four options, the address that each memory part occupies, and how jumper W4 should be configured to select each option. Each option maps the card to a different 16K quadrant of a 64K memory system. As shipped, the card is mapped to the last quadrant, address C000. The four optional starting addresses are:

0000
4000
8000
C000

The other versions of the 7706 have fewer memory parts installed. The 4K version has RAMs 0 and 1, the 8K version has RAMs 0, 1, 2, and 3.

Like the 16K version, these versions have only the four mapping options already mentioned. Therefore, an 8K card can be mapped, for instance, at C000-DFFF, but not E000-FFFF

If an 8K card mapped at E000-FFFF is needed, it is possible to configure one by using a 16K card and disabling the lower 8K. Using this method, any amount of RAM can be located at any part of the 16K quadrant in which the 7706 is mapped. Note that a card cannot be mapped to straddle a 16K boundary, such as B000-CFFF.

Tailoring Memory Size

The 7706 comes in three versions: 4K, 8K, and 16K. Its size can be tailored in 2K increments by disabling any unused memory parts. For example, a 12K card can be configured by using a 16K card and disabling two of the RAMs. When a RAM is disabled, the memory space that it had occupied becomes available to other cards in the system. Any number and combination of RAMs can be disabled.

To disable, cut one or more jumpers in jumper block W1. Figure 2-8 shows the location of W1 and indicates which jumper affects each RAM. Be sure to cut the jumper in two places to prevent reshorting. This feature can also add to the memory mapping flexibility. Refer to **Memory Addressing**. The address of each socket is shown in figure 2-7.

CAUTION

Users should not install additional memory parts in boards that are only partially populated. The memory parts Pro-Log uses are selected for low power consumption and severely tested, guaranteeing at least two years' data retention. Other sources of functionally compatible CMOS RAMs have been found to draw up to 100 times as much current. Such current drains would shorten battery life severely, making it impossible to determine when the battery will fail. If memory parts are added by the customer, Pro-Log will consider the warranty on battery life to be void.

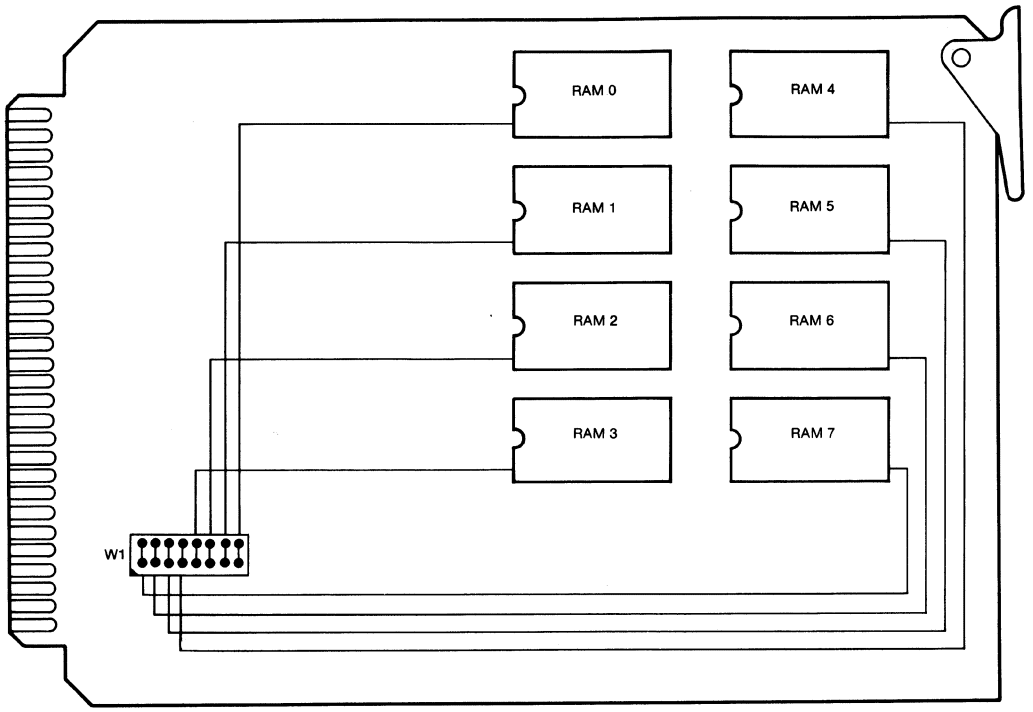


Figure 2-8. Chip Disable Jumpers

Specifications

			Recommended Operating Limits			Absolute Non-Operating Limits	
MNEM	PARAMETER	UNIT	MIN	TYP	MAX	MIN	MAX
VCC	Logic supply	Volts	4.75	5.00	5.25	0	5.50

Figure 2-9. Electrical Characteristics

			Recommended Operating Limits		
MNEM	PARAMETER	UNIT	MIN	TYP	MAX
Icc	Vcc supply current	mA		145	280

Figure 2-10. Electrical Characteristics

			Recommended Operating Limits			Absolute Non-Operating Limits	
MNEM	PARAMETER	UNIT	MIN	TYP	MAX	MIN	MAX
—	Free air temperature	°C	0	+25	+55	-40	+75
—	Humidity	% RH	5	—	95[1]	5	95[1]

[1]Noncondensing relative humidity

Figure 2-11. Environmental Characteristics

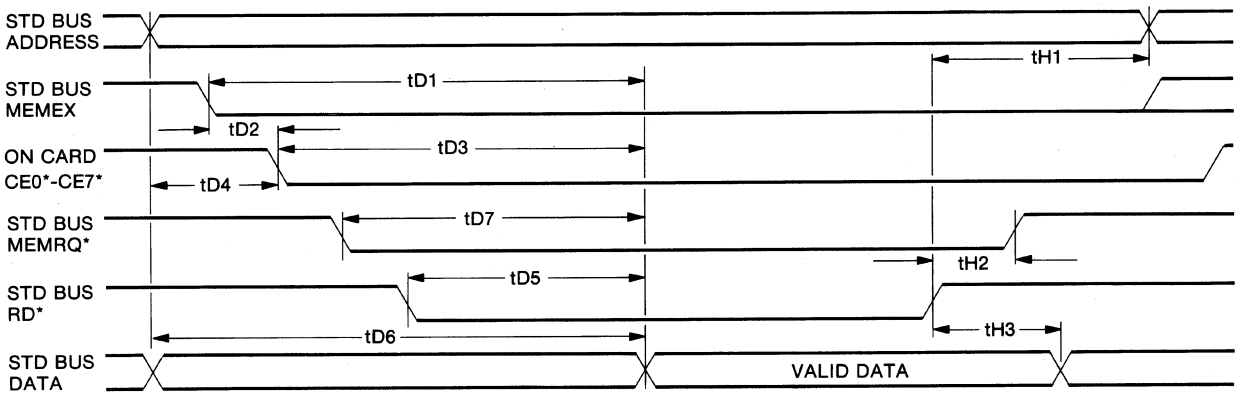
PIN NUMBER	OUTPUT (LSTTL DRIVE)			PIN NUMBER	OUTPUT (LSTTL DRIVE)		
INPUT (LSTTL LOADS)						INPUT (LSTTL LOADS)	
MNEMONIC							MNEMONIC
+5V	VCC		2	1		VCC	+5V
GROUND	GND		4	3		GND	GROUND
-5V			6	5			-5V
D7	1	55	8	7	55	1	D3
D6	1	55	10	9	55	1	D2
D5	1	55	12	11	55	1	D1
D4	1	55	14	13	55	1	D0
A15	1		16	15		5	A7
A14	1		18	17		5	A6
A13	7		20	19		5	A5
A12	6		22	21		5	A4
A11	6		24	23		5	A3
A10	5		26	25		5	A2
A9	5		28	27		5	A1
A8	5		30	29		5	A0
RD*	1		32	31		1	WR*
MEMRQ*	1		34	33			IORQ*
MEMEX	1		36	35			IOEXP
MCSYNC*			38	37			REFRESH*
STATUS 0*			40	39			STATUS 1*
BUSRQ*			42	41			BUSAK*
INTRQ*			44	43			INTAK*
NMIRQ*			46	45			WAITRQ*
PBRESET*			48	47			SYSRESET*
CNTRL*			50	49			CLOCK*
PCI	IN		52	51	OUT		PCO
AUX GND			54	53			AUX GND
AUX -V			56	55			AUX +V

* Low-level active logic
One LSTTL load = -0.4 mA

Figure 2-12. STD Edge Connector

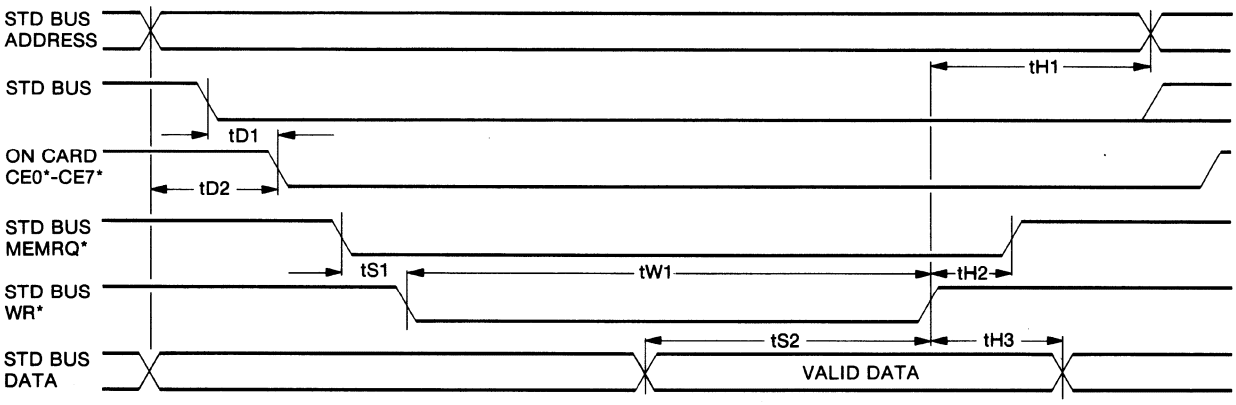
Mechanical Specifications

The 7706 meets all general mechanical specifications of the STD BUS.



		NANOSECONDS	
SYMBOL	PARAMETER	MIN	MAX
tD1	Data delay from MEMEX active		140
tD2	Memory chip enable delay from MEMEX active		130
tD3	Data delay from memory chip enable active		180
tD4	Memory chip enable delay from address valid		85
tD5	Data delay from RD* active		145
tD6	Data delay from address		345
tH1	Address hold after RD* inactive	20	
tH2	MEMRQ* hold after RD* inactive	10	
tH3	Data hold after RD* inactive	20	
tD7	Data delay from MEMRQ* active		195

Figure 2-13. Read Timing



SYMBOL	PARAMETER	NANOSECONDS MIN	NANOSECONDS MAX
tD1	Memory chip enable delay from MEMEX active		130
tD2	Memory chip enable delay from address valid		85
tH1	Address hold after WR* inactive	20	
tH2	MEMRQ* hold after WR* inactive	10	
tH3	Data hold after WR* inactive	20	
tS1	MEMRQ* setup before WR* active	75	
tS2	Data setup before WR* inactive	75	
tW1	WR* pulse width	115	

Figure 2-14. Write Timing

Section 3
OPERATION AND PROGRAMMING

INTRODUCTION

The operation and use of the 7706 card are explained in detail in this section.

WRITE INHIBIT SWITCHES

There are four Write Inhibit switches. Figure 3-1 shows their locations and the memory parts affected by each switch. Each switch protects one 4K block of memory. To inhibit writing, the switches should be in the **OFF** or **OPEN** position.

With the write line inhibited, the memory functions as ROM. These switches should be used when inserting or removing the card with data retention.

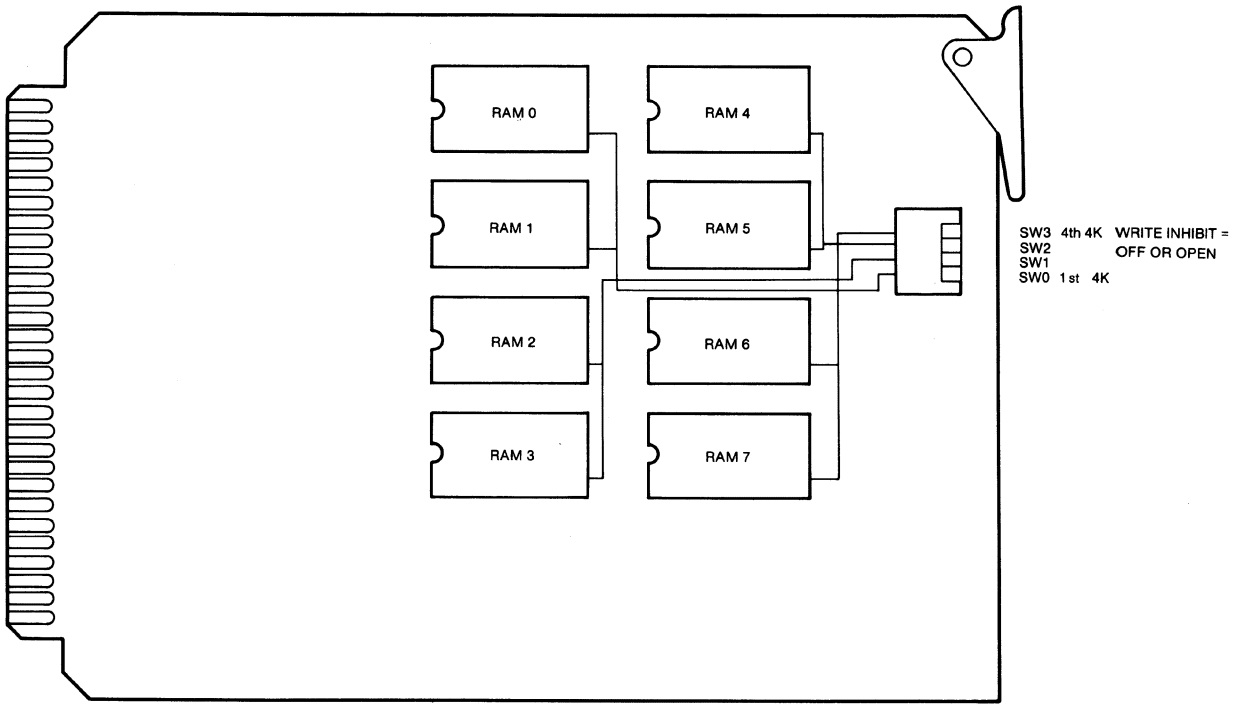


Figure 3-1. Write Inhibit Switches

POWERING DOWN AND UP WITH DATA RETENTION

Normal Power Cycling

Figure 3-2 shows flowcharts for turning power off and on and for removing and inserting the 7706 with data retention. The flowcharts involve some software and some manual operations. The three guidelines following the flowcharts must be observed when power cycling with data retention. These guidelines are incorporated into the flowcharts.

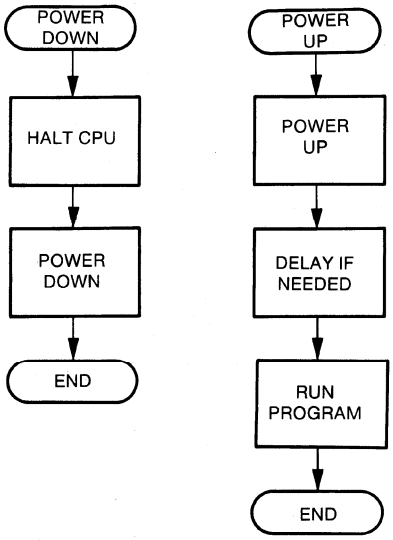


Figure 3-2A. Power Cycling Procedures

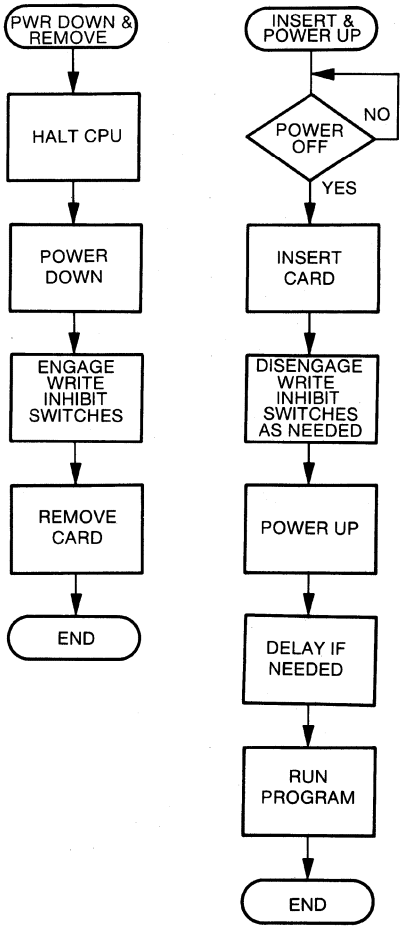


Figure 3-2B. Power Cycling Procedures

- **Prevent the processor from writing to the 7706.** Any data being written to the processor at the time it write-protects itself may not get written correctly. If in your application you need to avoid this possibility, the processor should be halted. This can be done by a HALT instruction or by inhibiting the processor through hardware (i.e., activating the WAITRQ* line).

Also, do not attempt to write to the 7706 immediately after power-up. The 7706 write protects itself whenever power is below normal. It is possible for the processor to be active before the 7706 is ready to accept data. If this is a possibility in your program, the problem can be avoided by putting a short delay at the beginning of your program. The required length of the delay is dependent on the rise time of your power supply.

- **Use the Write Inhibit switches when removing the card.** When removing or inserting the card, put the Write Inhibit switches in the **OFF** or **OPEN** position.

- **Never insert the card with power on.** When inserting or removing the 7706 or any card, be sure the power is off.

Data Retention During Power Failures

Figure 3-3 shows the procedure for retaining data during a power failure. The procedure also retains the address in the program counter when power goes down. It assumes there is power failure detection circuitry in the system (see figure 3-4). While the detection circuitry is not essential since the 7706 retains data through a power failure, it does have three advantages:

1. The processor will know in advance that power is going down. This gives it a chance to move essential data and the subroutine stack onto the 7706. Even if these are normally kept on the 7706, you may also need to store the contents of the registers.

2. A flag can be set to indicate to the processor, when it comes back up, that it has been through a power failure. This flag would be stored in a memory location on the 7706. When powering down normally, you would indicate to the system that you were powering it down and it would not set the flag. This indication would be given through some input such as a keypad (if there is one) or a pushbutton connected to a spare input line. When there is no such indication, as in an unexpected power failure, the processor sets the flag. When the processor comes back up, it can check the flag to know whether this is a normal power-up or whether it has just experienced a power failure.

3. The same circuitry can be used to halt the processor. This ensures that the processor is not writing to the 7706 when the 7706 write-protects itself. Data written at this time may not get written correctly.

The ability to halt the processor requires the detection circuitry to have two trip points: one to forewarn the processor, the other to halt the processor (by lowering the WAITRQ* line, for example). Or, alternatively, the processor can perform a HALT instruction when it finishes moving data onto the 7706.

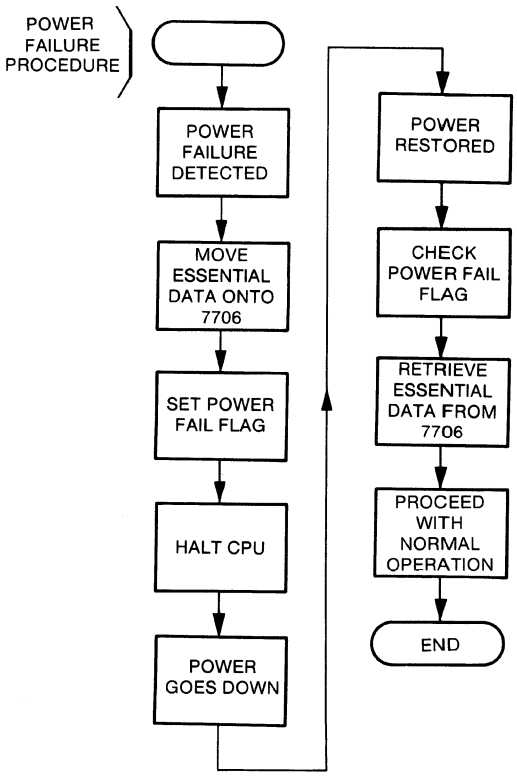


Figure 3-3. Power Failure Procedure

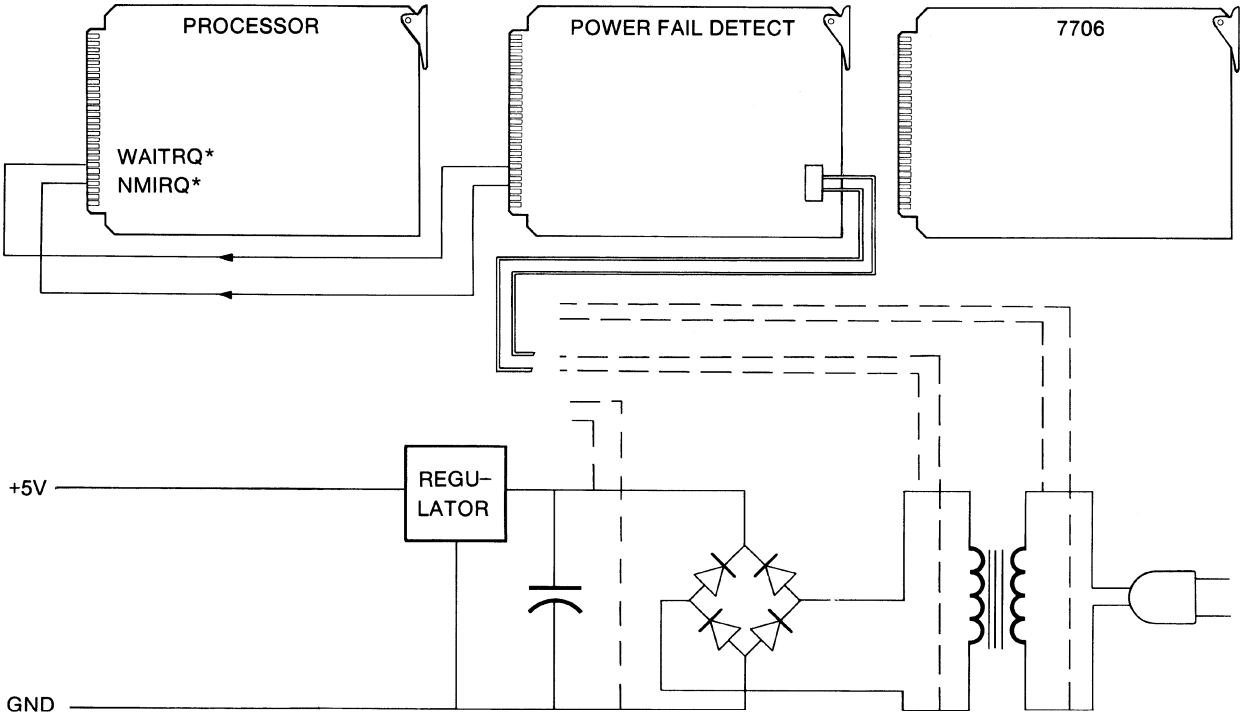


Figure 3-4. Detection Circuitry Example

REPLACE BATTERY* SIGNAL AND LED

The 7706 has onboard circuitry to monitor the battery voltage. It indicates when the battery life is down to approximately two weeks. It does this in two ways: When VCC is on, an LED at the front edge of the card illuminates and the Replace Battery* signal activates. This signal is accessible at a two-pin connector on the front edge of the card. The location of the LED and connector is shown in figure 2-2. Figure 2-4 shows how the signal can be connected. It can be input through an input port, in which case the processor has to scan the input from time to time, or it can be connected to an interrupt input. If an input port is used, any spare input line in the system can be used. Pro-Log's 7804 Z80A processor card has an input line onboard which can be used. If an interrupt input is used, a priority interrupt controller, such as the Pro-Log 7320 card, or an interrupt input on the processor card can be used. Pro-Log's 7801 processor card has interrupt inputs available on the card. Instructions for replacing the battery are given in section 5 of this manual.

MEMEX

MEMEX is an STD BUS signal. It is usually controlled by a memory segment controller or an output port. Most Pro-Log processor cards have the ability to control MEMEX. Its function is to allow two banks of memory of up to 64K each to reside in one system. One bank is enabled when MEMEX is high, the other when it is low. It is useful for expanding memory beyond 64K and in bootstrapping. In bootstrapping, the MEMEX line is used to enable the bootstrap PROM at power-up and switch to a block of RAM after bootstrapping is completed.

Figure 3-5 shows an example of how MEMEX can be used in a typical systm. The system controls a robot arm working on an assembly line. It has sensors to input data concerning the equipment to be worked on. The data gathered from the analog sensors is temporarily stored in the system. Calculations are then performed on the data and instructions are output to the robot arm.

The main memory of the system consists of 56K of ROM and 8K of RAM. This is divided between the processor card and the 7704 memory card. The 8K of RAM is used for manipulating data, scratchpad RAM, and for the subroutine stack. More RAM, therefore, is needed to store data as it is received until it is used. A second bank of memory is used for this purpose and the 7706 resides in this bank.

The 7706 resides in the same address space the 7704 occupies. Only one card is enabled at a time, however; the processor has an onboard I/O port to drive the MEMEX line. By setting the MEMEX line either high or low, the processor can choose which card is enabled. The memory onboard the processor card itself is permanently enabled, that is, it ignores MEMEX.

The processor can enable the 7706 when it is receiving data and store the data there. It can then move the data in blocks, through the RAM on the processor card, to the 7704. There it can perform calculations on the data. By manipulating the MEMEX line the processor can choose which bank of memory it is working with at any time.

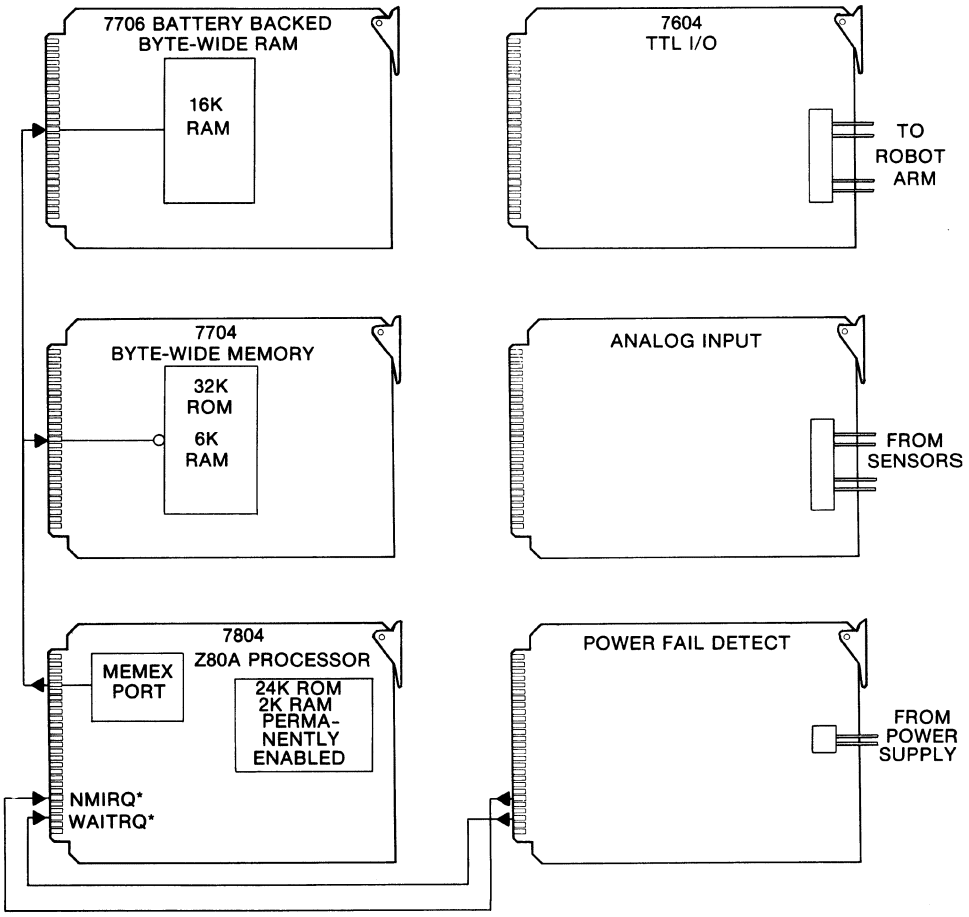


Figure 3-5. MEMEX Example

SEGMENT SELECT

Segment Select is an external signal that selects one of any number of memory banks. MEMEX allows only two banks. Segment Select can be controlled by a memory segment controller or by output ports. One output port can control eight segments. A segment can be made up of one or more cards.

Figure 3-6 is an example of how Segment Select can be used. The system inputs data from a number of remote stations via a modem. It collects data throughout the evening, deciphers and organizes it. In the morning, the information is passed on to the host system.

The processor card has 32K of permanently enabled memory onboard. The data is received through the dual UART card. It is stored in two 32K segments, each consisting of two 16K 7706 cards. A third segment consists of 32K of RAM on the 7704 card and is used as data manipulation space. A 7605 card is used to select the segments.

The 7704 is enabled with its Segment Select line low. The two segments of 7706s are enabled with their Segment Select lines high. After reset or power-up, the 7704 is enabled. The processor can thereafter choose the segment to address by manipulating the output bits of the 7605.

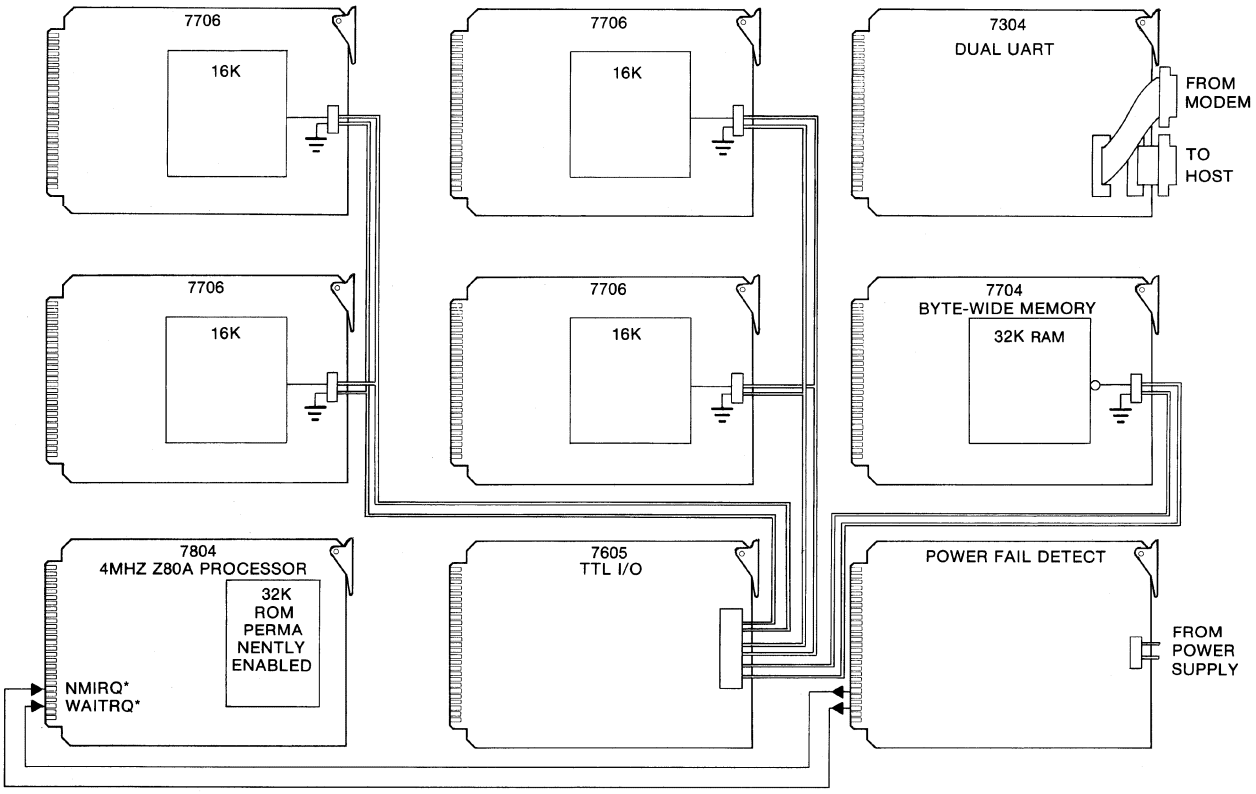


Figure 3-6. Segment Select Example

Section 4
OPERATING SOFTWARE

Section 4 is usually reserved for software for operation of an STD Series 7000 card. The 7706 card requires no operating software.

Section 5
MAINTENANCE

INTRODUCTION

This section contains information on replacing and handling the lithium battery. The schematic and assembly drawings are included here, as well as return for repair procedures and warranty information.

HANDLING THE LITHIUM BATTERY

The battery on the 7706 is a Lithium Bromide battery, a particularly safe form of lithium battery. For handling and disposing of the batteries in small quantities, no special guidelines need to be followed other than those given below:

- **Do not short the battery.**
- **Do not expose the battery to fire.**
- **Do not open the battery.**
- **Do not recharge the battery.**
- **Do not expose the battery to temperatures greater than 70°C.**

CHANGING THE BATTERY

When the battery voltage falls to approximately 2.4V, the Replace Battery LED and Replace Battery* signal activate. At this point, approximately two weeks of battery life remain.

To change the battery, first read the instructions for handling the lithium battery given above. Then remove the nonconductive protective backing from the 7706.

> CAUTION
>
> Do not set the card down on any conductive material or any any way short the battery.

Next, remove jumper W5, shown in figure 2-5. Desolder and remove the battery and replace it with a new one. Additional batteries can be purchased from Pro-Log (part number 902663).

Battery current should be checked to ensure that the circuit is working correctly. This can be done by connecting a 100-ohm resistor across the two posts of W5. The voltage across the resistor should measure no more than +0.003V, although it may be considerably less. If the reading is greater than this, remove the resistor, leave the battery disconnected, and call Pro-Log Customer Service.

If the reading is correct, remove the resistor and replace jumper W5. Replace the nonconductive protecting backing with a new pad. Spare pads can be purchased from Pro-Log (part number 107100).

REFERENCE DRAWINGS

The schematic (figure 5-1) and assembly drawing (figure 5-2) in the following pages are included in this manual FOR REFERENCE USE ONLY. These drawings may differ in some respects from the card you receive from Pro-Log. If you require the specific revision documents of the schematic and assembly for the board shipped, please use the information request form in the back of this manual to order them.

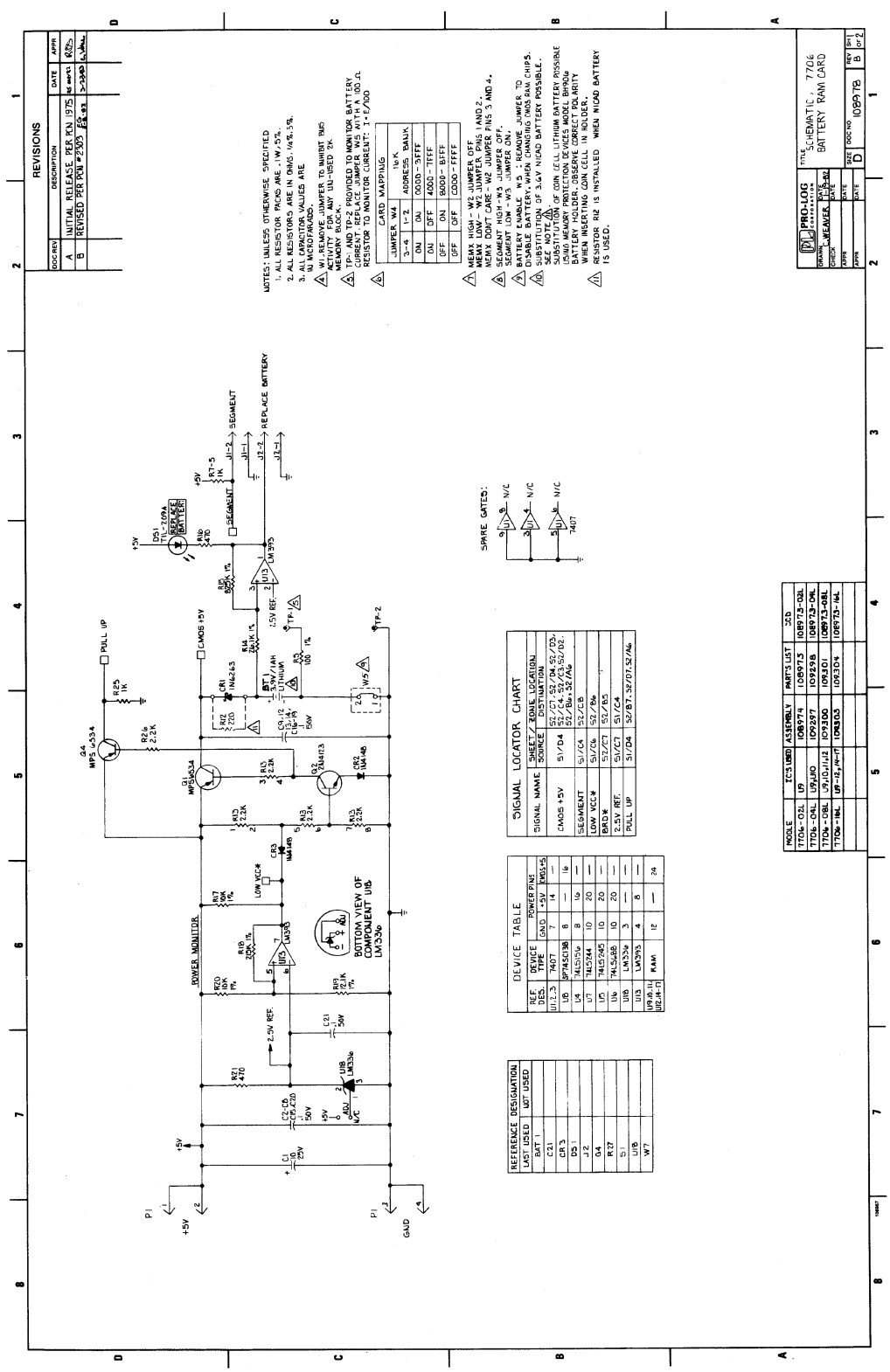


Figure 5-1. Schematic (Page 1 of 2)

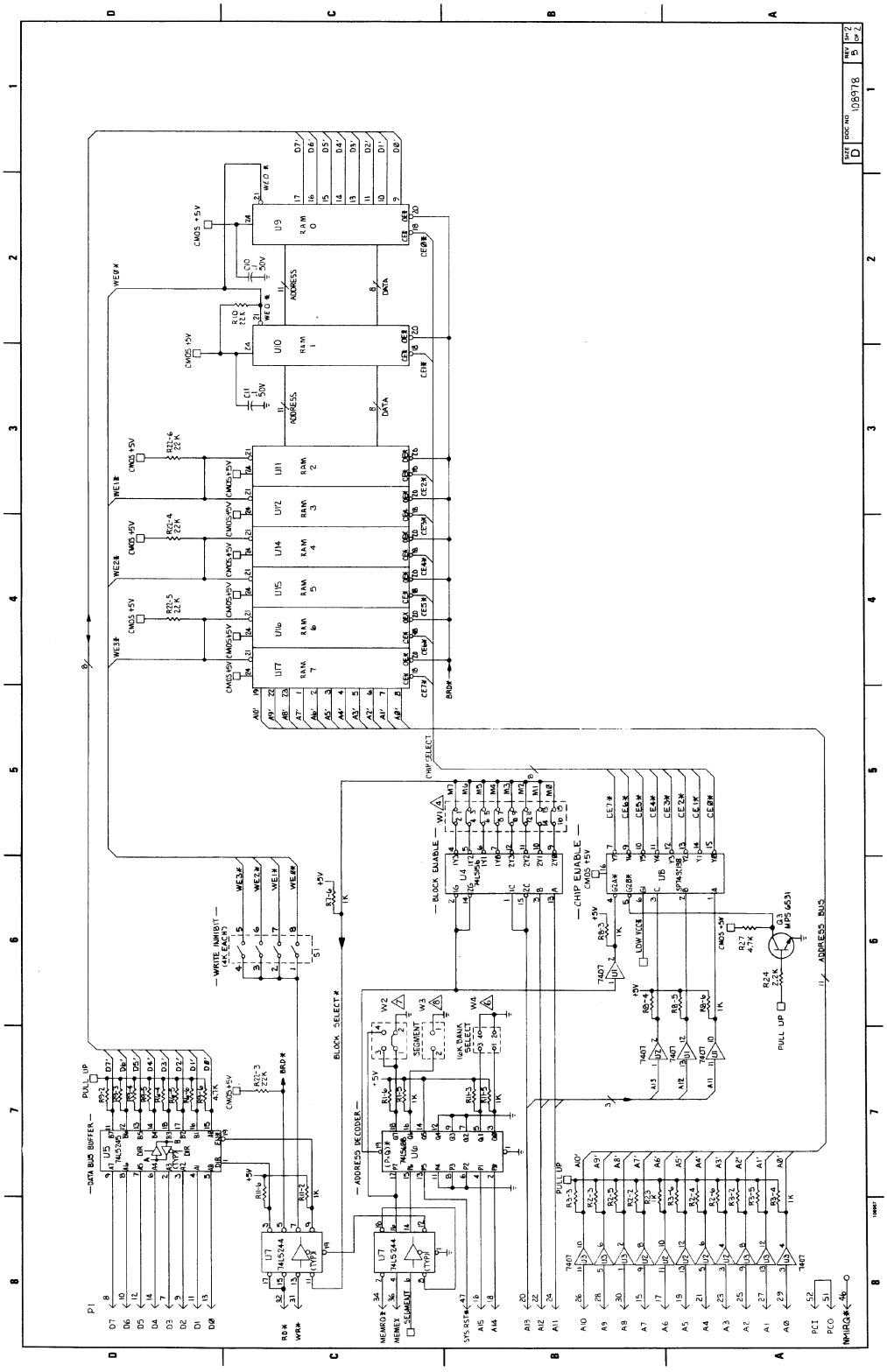


Figure 5-1. Schematic (Page 2 of 2)

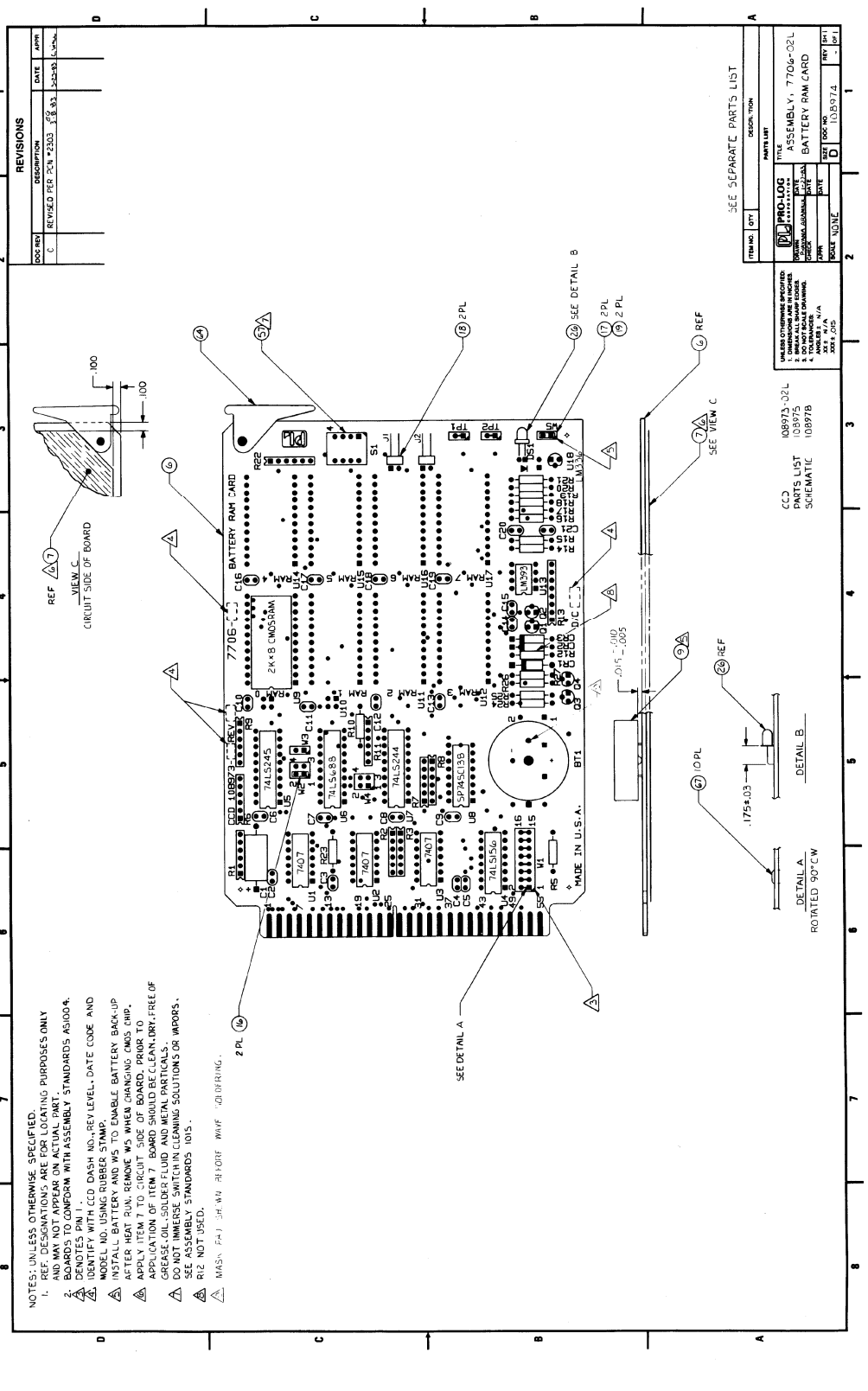

REVISIONS
DESCRIPTION
DATE
REVISED PER ECN #2303
SEE SEPARATE PARTS LIST
PRO-LOG
TITLE
ASSEMBLY, 7706-02L
BATTERY RAM CARD
DOC NO
108974
SCALE NONE
BATTERY RAM CARD
7706-02L
2K×8 CMOSRAM
MADE IN U.S.A.
VIEW C
CIRCUIT SIDE OF BOARD
DETAIL A
ROTATED 90° CW
DETAIL B
SEE DETAIL A
SEE DETAIL B
SEE VIEW C
CCD PARTS LIST 108973-02L
SCHEMATIC 108975
108978
NOTES: UNLESS OTHERWISE SPECIFIED.
1. REF. DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND MAY NOT APPEAR ON ACTUAL PART.
2. BOARDS TO CONFORM WITH ASSEMBLY STANDARDS AS1004.
DENOTES PIN 1.
IDENTIFY WITH CCD DASH NO., REV LEVEL, DATE CODE AND MODEL NO. USING RUBBER STAMP.
INSTALL BATTERY AND W5 TO ENABLE BATTERY BACK-UP AFTER HEAT RUN. REMOVE W5 WHEN CHANGING CMOS CHIP.
APPLY ITEM 7 TO CIRCUIT SIDE OF BOARD, PRIOR TO APPLICATION OF ITEM 7. BOARD SHOULD BE CLEAN, DRY, FREE OF GREASE, OIL, SOLDER FLUID AND METAL PARTICALS.
DO NOT IMMERSE SWITCH IN CLEANING SOLUTIONS OR VAPORS.
SEE ASSEMBLY STANDARDS 1015.
R12 NOT USED.
MASK FOR SHAVE AND SOLDERING.

Figure 5-2. Assembly Drawing

RETURN FOR REPAIR PROCEDURES

Domestic Customers:

1. Call Customer Support at (800) 538-9570, ext. 3617. In California call (408) 646-3617 from 7 a.m. to 4 p.m. (Pacific Time).

2. Explain the problem and we may be able to solve it on the phone. If not, we will give you a Customer Return Order (CRO) number.

3. Please be sure to enclose a packing slip with CRO number, serial number of the equipment, if applicable, and reason for the return, with the name and telephone number of the person we should contact (preferably the user), if we have any further questions.

4. Pack the equipment in a solid cardboard box secured with packing material.

CAUTION

Loose MOS integrated circuits, or any product containing CMOS integrated circuits, must be protected from electro-static discharge during handling and shipping. Use conductive foam pads or conductive plastic bags, and never place MOS or CMOS circuitry in contact with Styrofoam materials.

5. Ship prepaid and insured to:

   Pro-Log Corporation
   2560 Garden Road
   Monterey, California 93940

   Reference CRO
   #_____

International Customers

Equipment repair is handled by your Pro-Log distributor. If you need to contact Pro-Log, the factory can be reached at any time by TWX at 910-360-7082.

Limited Warranty

Limited Warranty: Seller warrants that the articles furnished hereunder are free from defects in material and workmanship and perform to applicable, published Pro-Log specifications for five years from date of shipment on STD BUS Series 7000 cards and two years for PROM Programmers. This warranty is in lieu of any other warranty expressed or implied. In no event will Seller be liable for special or consequential damages as a result of any alleged breach of this warranty provision. The liability of Seller hereunder shall be limited to replacing or repairing, at its option, any defective units which are returned F.O.B. Seller's plant. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. Seller shall have the right of final determination as to the existence and cause of defect. As to items repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for ninety (90) days following date of shipment by seller of the repaired or replaced part whichever period is longer. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to custom equipment or products produced to Buyer's specifications except as specifically stated in writing by Seller and contained in the contract.

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- ☐ STD BUS Systems
- ☐ Designer Software
- ☐ Design Courses and Seminars
- ☐ Programmer Product Line
- ☐ Other _____

- ☐ I am currently using Pro-Log equipment.
- ☐ Add my name to your mailing list.
- ☐ Please have a Sales Representative contact me.

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